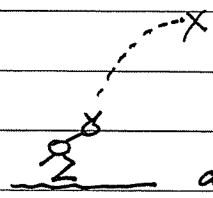
LAW OF CONS. OF ENERGY.

#1



a) E_g RELATIVE TO GROUND = 0 J

b) $E_k = 2.7\,kJ$ $\therefore$ $M.E. = E_g + E_k = 2.7\,kJ$

c) ENERGY IS CONSERVED $\therefore$ M.E. AT TOP = 2.7 kJ.

d) E_k AT TOP = 0 J assuming it jumps straight up.

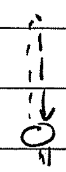
e) $\because$ $M.E = E_g + E_k$ and $E_k = 0$, then $E_g = M.E. = 2.7\,kJ$.

f) $E_g = mgh$

$2700\,J = (9.1)(9.8)h$

$h = 30.3\,m$

#2.



$E_g' = mgh$
$E_k = 0$

$E_g = 0$
$E_k = \frac{1}{2}mv^2$

$M.E_b = M.E_a$

$\frac{1}{2}mv^2 = mgh$

$\frac{1}{2}(10)^2 = 9.8h$

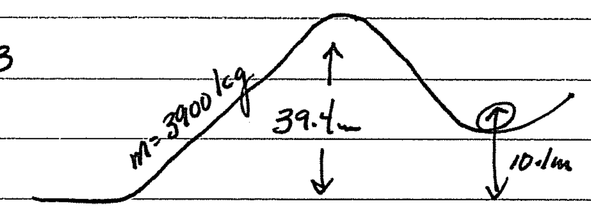
$h = 5.1\,m.$

#3 (NEXT PAGE)

#4 This scenario does not violate the Law of Cons. of Energy.
The object does not reach the same height
→ it lost some E_g.

The energy loss was transfered into thermal energy
→ into ground on impact
→ into ball as the molecules were squished.

#3



a) AT TOP, $h = 39.4m$ $\quad M.E = E_g + E_k$

$v = 1.0 m/s$

$= mgh + \frac{1}{2}mv^2$

$= 3900(9.8)(39.4) + \frac{1}{2}(3900)(1)^2$

$= 1507818 J$

b) MECHANICAL ENERGY IS ASSUMED TO BE CONSERVED HERE.

$M.E_b = M.E_a$ $\quad \because E_k = \frac{1}{2}mv^2$

$1507818 = mg(10.1) + E_k'$ $\quad \therefore 1121796 = \frac{1}{2}(3900)v^2$

$E_k' = 1121796 J$ $\quad v = 23.98 m/s$

c) $M.E_b = M.E_a$

$\cancel{m}gh + \frac{1}{2}\cancel{m}v^2 = \cancel{m}gh' + \frac{1}{2}\cancel{m}v^{2'}$

$gh + \frac{1}{2}v^2 = gh' + \frac{1}{2}v^{2'}$ ⟸ SOLN DOES NOT DEPEND ON THE MASS TERM.

d) $F_f = \mu F_N$ $\quad F_N = mg$ $\quad \therefore$ as mass increases, so does F_N + thus so does friction

e) IN ORDER TO NOT WORRY ABOUT FLUCTUATING MASS FROM RIDE TO RIDE, ENGINEERS:

1. Don't have any point in the ride being as high as initial point
2. Make highest point "higher" for margin of safety
3. Give the car initial kinetic energy to compensate for energy losses due to friction